THE OPTICAL

MAGIC LANTERN

JOURNAL

AND

PHOTOGRAPHIC ENLARGER.

EDITED BY J. HAY TAYLOR.

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Notes.

WE have within the last few days had the opportunity of inspecting an entirely new form of lantern of the automatic type. Space for a drawer containing fifty slides is provided underneath the lantern. The charged drawer having been stocked and put into place, one turn of a crank handle suffices to cut off the projected slide and change it for another with a rapidity that is astonishing. In order to see how quickly the instrument could be worked, we turned the handle about the speed one sees the handle of a barrel organ turned, when in the short space of about thirty seconds the whole fifty slides were removed from the drawer one at a time and replaced again. The mechanism used is very simple and not at all liable to get out of order. We will endeavour to have a drawing of this wonderful lantern ready in time for our next number, and may safely make the assertion that, owing to its compactness and certainty of not getting out of order, it is destined to become popular.

* * *

AN ink that is not affected by water, and which is good for writing on glass, for such purposes as diagram slides, is obtained by mixing 15 parts of turpentine with 10 parts of shellac, 3 parts Venice turpentine, and 3 parts of fine lampblack.

* * *

THE second annual dinner of the Hackney Photographic Society took place on the 2nd ult. at the "Grasshopper" Tavern, Gracechurch Street, E.C., Dr. Roland Smith, President, in the chair. After due attention to the viands, which were of great variety, a pleasant evening was spent, many of the members and friends contributing songs, recitations, and instrumental music. This Society is not only in a flourishing financial state, but it numbers amongst its supporters many of the leading men connected with the photographic art-science.

* * *

At 55, Surrey Street, Sheffield, a new depôt for the sale of photographic and lantern goods has just been opened by Mr. H. Jasper Redfern. Mr. Redfern has made many friends in the photographic line during the ten years that he has been in the employ of Messrs. Watson and Sons, of London, and that, combined with his extensive knowledge of the requirements of customers, will do much towards giving him a good start now that he has launched out on his own behalf.

* * *

During the past eight years the number of accidents resulting from gas cylinders have been comparatively small when compared with damage done by the bursting of soda water bottles, to say nothing of losses by reason of damage by the explosions caused domestically by household gas. During the time stated there have been, we think, four deaths by means of cylinders, and the cause of each having been pointed out, due precautions are taken to avoid them in future, both with the cylinders themselves and the machinery by which they are charged. With the results of past experience, we think compressed gas in cylinders will in future be considered absolutely safe.

* * *

Mr. W. Lawson, the inventor of the saturator bearing his name, has just received a diploma of honourable mention and a medal from the lady managers of the late Chicago Exhibition for the saturator exhibited there. We learn that Mr. Lawson has fitted up extra plant for the manufacture of saturators.

—:o:—

Expert Evidence about the Bursting of a Gas Cylinder.

On the 5th ult., Mr. Arthur Langham, Deputy Coroner, held the third sitting at the City Mortuary, with reference to the death of William Holbrook, who was killed by the explosion of a gas cylinder at Fenchurch Street station.

We do not think a full report of the proceedings would be of interest to our readers, as there was a great deal of evidence taken which practically had no bearing upon the real or supposed cause of the explosion.

Mr. Alexander T. Clarkson, during his examination, deposed that the cylinder was supplied by Messrs. Stewart & Clydesdale, of Glasgow, and was what is known as lap-welded; made from rolled sheet welded into tubes cut to the required length, one end is welded up solid in a spherical shape, and the other end drawn and screwed to receive the valve. All this part of the manufacture is done in Scotland. In tapping the ferrule end, oil is used by the maker, but on the arrival of the cylinders at Messrs. Clarkson's works they are put into a furnace and heated to eliminate, or burn out all oil that had been used, the valve is then fitted, this is done by screwing it into the far end, and finally it is soldered. The process of soldering has to be carried on with the metal used for this purpose kept in a molten state, and as the valve is screwed home, sometimes a bead or two of the solder is carried down into the cylinder, this is what one often hears rattling inside upon handling a cylinder, but it does not in the least degree affect the gas or endanger the cylinder.

Mr. James B. Spurge, Chemical Engineer, next explained how the oxygen gas was manufactured, and showed by means of diagrams the way in which it was filtered and purified, and finally compressed into the cylinders, as shown in diagram on next page.

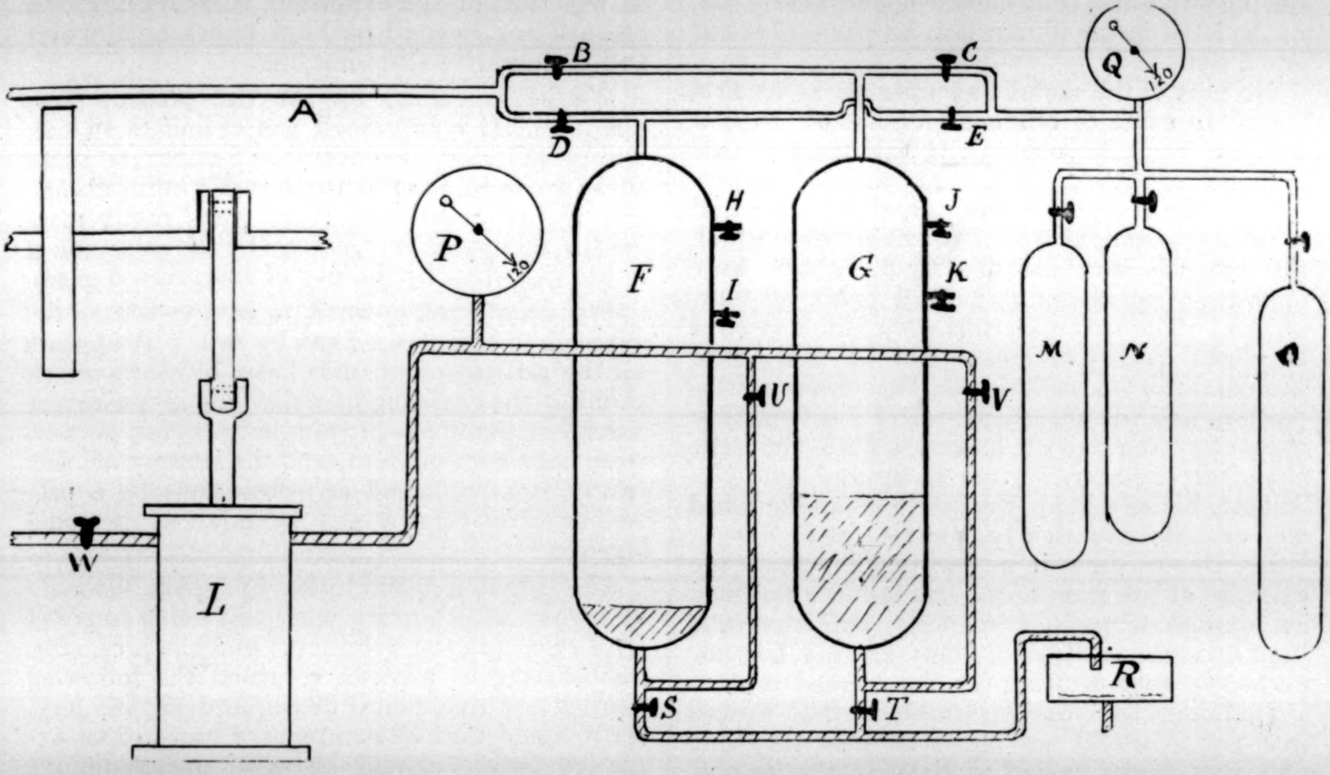
Mr. Kenneth S. Murray, M.I.Mech.E., when examined, stated that the firm who made the cylinder where among the best of makers.

Dr. Dupré attested that the composition of the metal, chemically, was of a high quality, but rather too hard and not sufficiently ductile; the internal diameter of the cylinder was $3\frac{3}{4}$ inches, and a little over $\frac{3}{16}$ in thickness, and on analysis contained:— Iron, 99·128; carbon, 0·107; manganese, 0·432; sulphur, 0·058; silicon, 0·011. This would be amply sufficient to safely withstand a pressure of 125 atmospheres.

We may here mention that during the process of filling there is a certain amount of heat generated which causes the gas to expand, so that when the bottle is fixed to the compressor it indicates 125 atmospheres, but upon cooling down to its normal state it will only register 120 atmospheres.

The cylinder had been tested by hydraulic pressure to 233 atmospheres; equal to 3,395 lbs. to the square inch, and so far as could be discerned on examination afterwards, it was perfect, but it had not been tested with water gauge indicated as recommended by Mr. Brier.

We think that the whole of the expert evidence goes to prove that the cylinder was properly made and valved, and, generally, a good and reliable one, and that it would have been perfectly safe when charged with the usual quantity of gas, 1,800 pounds to the square inch, which is only about half the pressure that the cylinder had been subjected to previously.



A Tube supplying chlorate gas from duplex pump.
B C D E Gas controlling taps.
F G Receivers for oxygen gas, charged alternately from 80 to 90 atmospheres.
H I J K Trial taps
L Hydraulic pump for displacing gas at 120 atmospheres into customers' cylinders, **M N O**.
P Q Gauges for checking pressure.
S T are valves for allowing the water after displacing the gas, to run to waste into sink **R**.
U V Valves for opening connection to either displacer.
W Inlet valve to pump.

We may add that Dr. Dupré, Mr. Kenneth S. Murray, Mr. Henry F. Brier, and all experts upon the subject, speak most decidedly as to the safety of cylinders when charged to the standard pressure, and with pure gases. Innumerable experiments have been carried out with a view to prove this; some cylinders have been thrown from heights varying from 35 to 50 ft., valves have been knocked off in transit, and cylinders charged with oxygen have been in burning buildings, in some cases the intense heat has melted the solder around the valve, and allowed the gas to escape, in other instances the cylinders have been intact, although bulged by the the increase of pressure inside caused by heat, but not a single trace of the gas has escaped. We believe one cylinder of abnormal thickness, viz., a quarter of an inch, did burst with the intense heat, showing that it is not advisable to have them made of too stout a material. If a bottle fully charged be dropped into boiling water at a temperature of 212° Fahr., it would only increase the internal pressure to about 155 atmospheres—to 2,325 lbs. to the square inch.

We understand that a cylinder out of the same batch as the one that exploded was tested to the bursting point, and it only gave way to a pressure of 500 atmospheres, equal to 7,500 lbs to the square inch—surely enough margin for safety.

Dr. Dupré in further testing a piece of the steel cut lengthways from the exploded bottle, found the elastic limit to be 25·15 tons=58,240 lbs. per square inch. Breaking strain, 30·16 tons =69,440 lbs. per square inch. Extension on a 3 inch piece 13·2 per cent. and a piece cut transversely to the length, elastic limit, 34·11 tons= 76,160 lbs. per square inch. Breaking strain, 35·19 tons=80,640 lbs. per square inch. Extensi on 1½ in. piece 18 per cent. He was of opinion that the bottle had been ripped open by a sudden force acting from the interior with considerable violence, and that previous to giving way, the bottle had obviously expanded, for upon measuring the part that had been ripped open it was found to be somewhat larger than the original size. At first the rent had run longitudinally along the cylinder, and at each end were two rents extending about two-thirds around the circumference of the cylinder, producing two flaps, bent outwards and nearly flat, as depicted in the illustration on page 56 of our April issue.

No part of the metal was missing as at first stated in some of our contemporaries, neither did the fracture occur along the weld of the cylinder.

The official report stated that Dr. Dupré had carefully examined the materials from which the oxygen was manufactured, which were chlorate of potassium and black oxide of manganese. The two materials were found to be of excellent quality and need not be taken into consideration in seeking for the cause of explosion, and the apparatus was of a satisfactory character, the report further stated that the chemical engineer, Mr. J. B. Spurge and Mr. Abbott, his assistant, were fully competent and well acquainted with what was required.

Dr. DUPRE gave it as his opinion that the cylinder at the time of the explosion contained an explosive gaseous mixture, and this was fired by some portions of finely-divided iron, or perhaps grease, igniting the compressed gas.

It should be clearly understood that coarse iron filings would not ignite in this way, but only very finely divided particles in the form of dust.

It appeared that the only weak point (if it can be termed such) in the construction of the whole apparatus consisted in using the same hydraulic pump or motive power for the purpose of compressing the gas in all cylinders:—oxygen and coal gas. The two sets of displacers were connected by means of branch pipes, these branch pipes being joined to one tube, forming the hydraulic main from the pump. At the junctions of each branch pipe are valves, and it is suggested that under a suitable difference of pressure, and two of the valves being open together, some of the gas might pass by this route into the other set, but it has always been the rule at the works that there shall be but a single key fitting the valves connecting the hydraulic main; when any valve is open, the key is left on and removed only when the valve is shut. But this was a very remote suggestion, as it is the rule in Mr. Clarkson's works to compress only one kind of gas at a time.

This is the second accident which has occurred within the last two or three years. It is in no way similar to the one that happened at Bradford, where the cylinder fell down and flew into many pieces. Although it ended so disastrously to poor Holbrook, it is generally granted by all whose opinion is worth having, that had the man been a yard or so away from the cylinder at the time of the explosion, it would not have harmed him, beyond, perhaps, knocking him over and temporarily stunning him.

We believe there are at the present time about 60,000 compressed gas cylinders in use, and considering the enormous number of times these are used, the risk run is really infinitesimal. Dr. Dupré mentioned there were many more deaths, comparatively, caused by the explosion of house gas, than by the use of compressed gases.

We have just a word to say respecting the carriage of compressed gas by rail. It appears all the railway companies have bye-laws which prohibit the carrying of cylinders in passenger carriages, but it was proved that very few persons were cognisant of them, and the railway officials rarely, if ever, raised any objections to a passenger conveying a gas cylinder as personal luggage.

The Coroner, in summing up, spoke strongly in favour of a Government test being imposed with regard to the cylinders; and the jury, after deliberating in private, returned the following verdict:—"Accidental death, and we, the jury, recommend that all compressed gases of an explosive nature should be scheduled under the Explosives Act, that all cylinders should be tested by the Government periodically, that no cylinder should be allowed to be used or conveyed about unless bearing the Government stamp, that all manufacturers should be licensed by the Board of Trade in the future, and that separate hydraulic pumps should be used in the apparatus in filling the cylinders, and we also recommend a Board of Trade and Railway enquiry.

Should the Board of Trade not see their way to adopt the proposal of the jury and Coroner, we would offer the following suggestions:—

(1). That the Government decide what should be the standard thickness of a given size cylinder. (The opinions of compressors vary on this matter.)

(2). The chemical composition of the steel and tensile strength.

(3). That the valve of all oxygen cylinders should have a different handed thread to coal gas cylinders.

(4) No cylinder which has been used for coal gas should be used for any other.

(5). All machinery used for compressing different gases should be entirely separate.

A few such simple rules as the above would remove all possibility of accident, and relieve the Government of appointing inspectors. At the same time, if they were issued by the Board of Trade, anyone infringing them would be liable to prosecution and subject to a heavy fine.

Finally, we may add that Mr. Clarkson is having his works entirely re-modelled, and will in future use separate machinery for each gas.

All cylinders will be carefully annealed and tested by hydraulic pressure, and will not only be emptied of any gas they may contain, but the air will be exhausted, oxygen valves will be fitted with right-handed threads, and coal gas valves with left-handed threads.

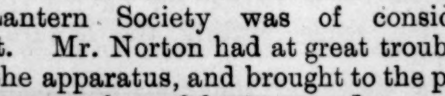
—:o:—

Candle-Power of Illuminants.

As a means of teaching how to compute the candle-power of a lantern, or other illuminant, Mr. Goodwin Norton's recent demonstration at the Lantern Society was of considerable interest. Mr. Norton had at great trouble prepared the apparatus, and brought to the place of meeting a number of lanterns and a variety of jets. Many of the visitors also brought jets, saturators, and oil lamps. Each illuminant was tried first in the lantern and then direct, the candle-power in each case being computed.

According to the calculations made, the candle-power varied (in the case of an oil lamp) from 28 to (a mixed jet) 5,933. It will be noted that absolute accuracy was not aimed at, as the time at disposal (one-and-a-half hours) was none too much in which to deliver a lecture and compute the candle-power of something like a dozen sources of light. Mr. Norton thoroughly explained the manner of means by which anyone could go to work for himself when desirous of computing candle-power.

Briefly, the *modus operandi* is as follows, and is set forth in the accompanying sketch.



(A) is a sperm candle of six to the pound burning at the rate of 120 grains an hour and designated a standard candle, (B) a Bunsen's disc, or sheet of paper containing a grease spot, (C) the light to be computed. By moving (B) nearer to, or further from the light, it will be observed by one looking from one side that at a certain distance between the two lights, the grease spot will not be discernible. This having been determined with great precision, the exact measurement must be taken between the light to be tested and the grease spot on the one hand, and the grease spot and the standard candle on the other. These are then squared and divided one in the other. In this instance we will suppose the distance to be as per the sketch, $12^2 = 144$ and $2^2 = 4$. 144 divided by 4 gives 36. The candle-power of the light would under these conditions be 36.

The necessity for exact measurements will be understood when we consider that in estimating this low candle-power, had an error of one inch been made in counting the distance between the grease spot and candle, the difference would have represented nearly three candle-power. On the other hand, in estimating a strong light, say at distances of 25 ft. at the one side, and three inches at the other, a difference of one inch in the latter would in the calculations show a difference of over 4,000 candle-power; thus 10,000 candle-power, or 5,626 candle-power. As the estimates at the Lantern Society were carried out by means of a long tape measure stretched across the hall, and held near the light by an assistant, measurements to within an inch could not safely be relied upon, so although one particular jet was calculated to give 5,933 candle-power, it is more than probable that with exact measurements this candle-power would dwindle down to a mere fraction of this sum.

Given a little latitude one way or the other, one would have no difficulty in estimating the candle-power of any illuminant to almost anything that suits his fancy, and yet be able to quote figures in support of the same.

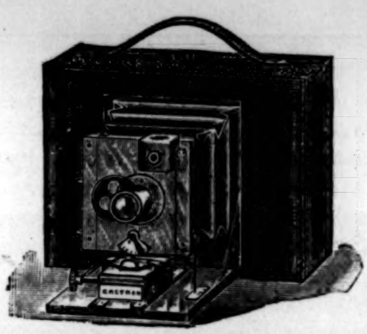
—:o:—

Hand Cameras for Obtaining Slides for the Lantern.

No. 33.—Flat Folding Kodak.

At this time of the year, it is the custom of thousands of our readers to use hand cameras for the purpose of obtaining suitable negatives from which to make lantern slides a little later on, and, as has been our custom in years past, we will, during the next few issues of this Journal, introduce them to high-class cameras which are admirably suited to this purpose.

The new flat folding Kodak, brought out by the Eastman Photographic Materials Co., has applied to it the well-known Kodak principle, but is made extremely light and folds up in very small bulk, of a shape that makes a convenient parcel for cycling or walking tours, and forms a most desirable companion. It is supplied with a roll holder and has a capacity of forty-eight film exposures, the size of picture being 5 by 4. A new arrangement for registering the number of exposures made has been added to this camera, and also a stop which prevents any overwinding of the film.



From the illustration it will be seen that to use the camera, a portion of the side opens and supports the camera front, whilst the rack shown in front can be used for focussing. It is fitted with a reversible finder, suitable for either vertical or horizontal work, and sockets are provided for attaching it to a stand.

The lens is of the rectilinear type and is supplied with an admirable shutter, the tension on which can be varied simply by adjusting a lever. The instrument is particularly neat, is covered with black morocco, the other parts being in brass and polished mahogany. The total measurement is 3½ by 6½ by 8½ ins., and the weight when charged 3 lbs. 8 ozs.

——:o:——

Lecture Notes.

By a Lantern Lecturer.

(*Continued from p.* 71.)

Let it be supposed that the subject for a new lecture has been chosen, and that the necessary slides have been selected. It is a *sine qua non* that these slides shall be in the possession of the lecturer for at least a week or two before the contemplated date, if proper justice is to be done to them. The only too frequent plan of hiring a set of slides for the one night cannot be too strongly condemned; it is a system, which, without exception, has done more to bring lantern entertainments into disrepute than anything else. If it be impossible to purchase the set right out, there is no doubt that it might be hired for a short period or a whole season on reasonable terms; probably the dealers would only be too pleased to loan sets during the summer months for the purpose of lecture preparation, if definite arrangements were made beforehand as to terms, etc.

Having obtained the slides, and collected from various sources, encyclopædias, etc., such facts and figures as bear on the subject, the next step is to write the lecture out at full length from the slides themselves. The writer's plan is to have each slide, together with the facts concerning it, before him, and then to scribble off an account or description of it as rapidly as possible, trusting to subsequent corrections and alterations to bring it into presentable form. The object of thus writing it out at full length is to obtain an easy and natural account of each slide in the lecturer's own customary language and style. Not only will the sentences thus composed be more easily recollected and more fluently spoken, but also it becomes an extremely easy matter to draw up notes which will serve as a perfect aid to memory. The reason for having the slide before one while writing the lecture is as follows:—

Having mastered the facts concerning the particular subject which the slide illustrates, the mere inspection of it suggests certain thoughts which occur in a natural sort of order; these thoughts and ideas, put into words, form the written lecture, and they will be recalled to mind without an effort whenever the particular slide appears upon the screen. Thus, to a great extent, the slides themselves become the necessary notes, each telling its own tale to the lecturer, who has but to reproduce in simple and straightforward language to his audience, the hints thus given him. On the other hand, where a lecture, with the idea of impressing an audience with its elegance and style, is composed in a language artificial and foreign to the speaker's usual and natural speech, the reproduction of it in a style and fluency suitable to its high-flown language is a difficulty which no amount of notes will overcome. In the majority of lantern lectures what is required is not an elegant banquet of words, and a far-reaching and learned disquisition on the subject which the slides illustrate, but rather a plain straightforward description of the picture on the screen. The average audience willingly listens to and enjoys ever so homely an account of what it sees before it; but seldom waxes enthusiastic over what the slide suggests, but does not actually show.

In writing out the lecture it is a good plan to use a separate sheet of paper for the account of each slide, so that it can be rewritten if necessary, or so that extra slides or matter can be added at any time without interfering with the rest of the lecture. In addition to the numbers which are generally used to designate the slides, it is a convenient plan to give a separate name or title to each. This title should be taken from some conspicuous and noticeable feature of the slide, so that the mere sight or mention of the word brings the particular slide clearly to the mind. For instance, three slides of St. Paul's Cathedral, instead of being known as Nos. 1, 2 and 3, may be named say, "Dome," "Crowd," and "Clock"; the first because the dome is very conspicuous and noticeable, the second because traffic, etc., is shown in the foreground, and the third because the clock, not shown in the other two views, is visible in this. This method of naming slides may sound rather troublesome and trivial, but it is most decidedly of practical value and importance.

With regard to the form of the remarks which are to accompany the exhibition of a slide, the writer usually endeavours to divide them into three separate parts. The first of these three is the introductory portion and brings the subject of the next slide before the audience. By the bringing in of the name of the coming slide into these introductory remarks, the operator receives his cue, and all signalling of any kind becomes quite unnecessary. Thus, in a lecture on Italy, if the last slide dealing with Rome has been shown, and the next is to be a picture of Naples, the introductory remarks might take this form: "No visitor to Rome, with time and means at his command, will omit to pay a visit to Naples. The distance is but slight, the facilities for making the trip are many," etc., etc. If "Naples" be the title of the slide, the mention of the word gives the operator the hint to introduce the "Naples" slide, and by the time the sentence following the word has been spoken, the audience has had a brief opportunity to take in the salient points of the picture and is ready to listen to the second and most important part—the description of it. If the slide to follow it is on the same subject it may be brought on without introductory remarks; but if there is somewhat of a break, and the new slide deals with a different matter, it is well to dismiss the slide then on the screen with a parting remark or two. Thus, in the case of the "Naples" slide, one might say: "This brief description has by no means done justice to the beauties of Naples, but there are so many other cities which claim our attention, that we must, perforce, pass on to them without loss of time." In these concluding words the operator will recognise a warning, and will be ready with the next slide the moment its title is mentioned.

Working on some such system as this, the only notes required are the name of the slide and a word or two which will give the lecturer a hint as to the introductory and concluding sentences. As to the second or descriptive part, the slide, when on the screen, should furnish all the necessary hints and notes; though, of course, a few dates and figures, etc., will sometimes be needed. The notes on the slide mentioned above might run thus:—

24. NAPLES.
VISITORS.
SLIGHT.
1857 A.D. 30 MILLIONS.
JUSTICE.
OTHER CITIES.

The notes are written down in the above scattered fashion, as, when arranged in this way, they are more easily read, in fact, with a single rapid glance it is possible to take in all the information they have to convey. It will be noticed that the words "visitor," "slight," etc., used as cues, actually occur in the introductory remarks. Presupposing that the written lecture has been read through, if aloud so much the better, several times, it will be found that the giving of the actual word to be used is very helpful, giving one a start in the sentence as it were. On the other hand, the unpractised speaker, to whom these remarks are addressed, will find that he will derive but little benefit from such notes as "give reason for introducing Naples—describe it—explain reason for treating briefly with it, and then go on to Vesuvius," etc. It is all very well to say "go on to Vesuvius," but what the tyro wants is the word which will recall to him the sentence he originally planned to introduce the subject of that noted volcano.

The making up of these notes should be taken in hand as soon as the lecture is fully written out, and after the latter has been studied awhile, let the attempt be made by way of rehearsal, to give the lecture a few times from these notes. Some will be found altogether unnecessary, the mere name of the slide being sufficient to furnish all the information required; others will need additional words or further alteration time after time until the final edition of the notes will be a mere skeleton of the first one, containing only such facts, figures and hints, an experience has found to be necessary. To anyone except their author they are utterly unintelligible, but to him they are full of suggestion, aiding him exactly at those points where he most needs help.

Certain lectures often require something of the nature of a summary or peroration to be spoken, and under such circumstances a little exuberance of language is allowable or even desirable. In default of learning such a passage off by heart, notes consisting of certain of the phrases and works occurring in it are a wonderful help in speaking it. Sometimes it may be desired to repeat a passage taken from some writer. In such a case the memory is much aided by adopting the plan mentioned above. Suppose this is to be the passage:

"Vast, slow and continuous as are the changes which geology brings to our notice, they occur within defined limits. The deep ocean basins, the lines or seams of the great mountain chains, have probably been permanent from the remotest geological epochs, and the variations in land and water distribution, although enormous and unceasing, have been confined to certain areas. All the evidence furnished by the aqueous rocks, from the earliest primary to the alluvial formations of to-day, point to their tranquil deposition on the floors of relatively shallow seas, where they have been converted by pressure and other means into solid beds, entombing organic remains which give the key to their relative place. Then, on their upheaval above the sea, the eroding agents have begun their slowly levelling work, and the *debris* of lands, where life-forms have flourished and perished, have returned to the waters whence they uprose, to become once more the dust of continents to be."

The following words might be selected as notes and arranged in somewhat this form:—

CHANGES.
BASINS PERMANENT, VARIATIONS CONFINED.
EVIDENCE FURNISHED.
TRANQUIL DEPOSITION.
ENTOMBING.
ON UPHEAVAL.
DUST.

With such helps as these, the poorest memory can quickly master the whole passage and render it again, not in the monotonous voice of one who has learnt it by heart, but intelligently and naturally.

Such a system is undoubtedly laborious and entails a considerable amount of work, but the result justifies it; for one of the surest roads to success in lecturing is to thoroughly realise the difficulty of it. It is the duty of everyone who attempts to give a lecture to do his utmost by every means, whether mechanical or otherwise, and to take all possible pains and precautions, and in this matter the use of notes may be made of first importance. With suitably arranged notes before him, the would-be lecturer will find his attempts more successful, and, at the same time, he will find that his prestige as a speaker will not suffer in any way from the fact that he openly makes use of them.

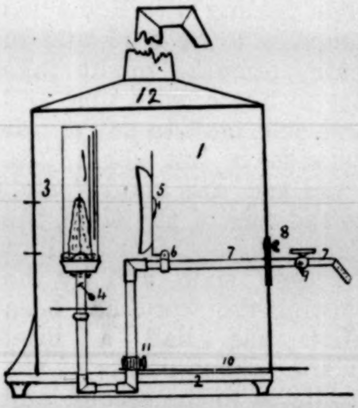
———o:———

Welsbach's Patent Incandescent Gas Lamp applied to the Magic Lantern.

BY D. MCKAY.

MY incandescent gas lamp is one of the commercial kind, and has got one of Welsbach's patent caps, which fits over the burner just under the mantle, which prevents the air from curling up the bottom part of the mantle, and thus keeps it in its proper shape and position. My lantern is one of the larger size than those generally used. The sketch herewith will show the way I have applied it to same.

Fig. 1 represents the lantern body, Fig. 2 the bottom of the lantern, Fig. 3 the incandescent lamp, Fig. 4 is the bye-pass tap, Fig. 5 the reflector, which is clasped to the pipe that supplies the gas to the lamp, and which is suspended by a steel wire (see Fig. 6). With this lamp and reflector out of the lantern, and you are standing in a right line with same, you can see to read a newspaper twenty yards distant. Fig. 7 is the supply pipe, Fig. 8 is a clasp, which clasped around Fig. 7 and thumb-screwed to the back of the lantern, keeps the supply pipe in its proper place, and bears the weight of the india-rubber pipe. Fig. 9 is the shut-off tap; Fig. 10 is the tray which slides in the bottom of lantern; Fig. 11 is a collar with a small set screw, which pinches the



supply pipe that passes down through the centre, and enables the lamp to be raised and lowered, and turned from right to left as required; the collar is soldered to the inner end of the tray. Fig. 12 is the form of the top of the lantern. The glass chimney of the incandescent lamp fits nearly under the air hole at the top of the lantern, which is 4 in. in diameter, and when required the draught can be increased or decreased as required by the lantern chimney. This plan, which I have adopted, works well.

—:o:—

Is the Lantern Played out ? No. No. III.

(*Continued from page* 50.)

PRACTICAL SUGGESTIONS.

By Amy Johnson, LL.A. (*Author of "Sunshine."*)

The experiment alluded to is so simple that, at home, there is no need for any lantern (but in the lecture-room remove the smaller lens above described). All that is needed is to place a bowl of water on a table or washstand where the sun shines on it, and stamp very gently on the floor. On the ceiling or wall will appear an image of exceeding beauty—a beauty which will probably be lost to those readers who would rather be bidden go and do some great thing. The children will learn much from this experiment. Float a chip—pencil cutting—on the surface. Call it a ship. Bid them observe how it is lifted up and down as the waves pass under, showing that it is swinging in a vertical plane.

Show the vibrations of pine rods, straightened clock spring, or knitting needle with silvered bead, of strings, etc. Space forbids more than passing mention, for details I refer you to the text books. All that is necessary here is to show that this property of swinging is common to all elastic bodies. Now call out a few boys, arrange them in single file, hands resting on the shoulders of the boy in front. Give the last boy a push—the front boy falls forward. Why? You will probably have to repeat this experiment, as its effect will be lost on your audience first time. The points to prove are these: (1) The push is passed on from Dick to Tom, from Tom to Harry, and so on through the series; (2) each boy stands firmly on his feet, and only sways his body to and fro as a pendulum, and comes to rest; the last boy does not change places with the first or go up to him, and yet, by the action of the last boy the front boy is thrown forward. The same effect can be shown by marbles or billiard-balls in a groove.

I was proceeding to return a book to its place at the end of a shelf, and, I suppose, must have given its neighbour a slight push. Instantly the book at the other end of the shelf fell down, but, unlike the boys or the marbles, I observed the row of books continued to lean slightly after passing on the push. Why? Because the books did not possess sufficient springiness or elasticity to bring them promptly back to their former position.

Having made this point clear, proceed to show that all bodies, when giving forth sounds, are in a state of tremor or agitation, or, we might say, swinging. This statement always occasions surprise. A table bell, when ringing, shows a fuzzy shadow on the screen. Laying a match across two fingers of the left hand, open them as wide as possible, strike the tuning fork, and bring it just below the match, which will instantly be kicked up into the air. Strike the fork again, and hold it to the lips of some child near, and ask him or her to describe the sensation. Then by shadow projection, using vertical attachment, throw on the screen a still more striking experiment. Take a tumbler brim-full of water, and bring both vibrating prongs of the fork upon the surface; this makes a fine spray effect when magnified.

Further, every elastic body has its own period or particular rate of swinging, which is determined partly by the material of which it is made up, and partly upon its size and shape. A stretched string, a board, a lath, a bridge, a house have each a certain period of vibration, into which they can be brought by some well-directed sudden push or pushes. When a strong wind shakes a building, the shake is the vibratory rate of the building, and may be as low as one or two per second. This rate increases as the bodies are smaller, and when it becomes more rapid than thirty or forty per second the effect can be heard as well as seen. Smooth bits of laths of different lengths give out their tones when dropped on the table, and with a properly graded set tunes may be played by dropping them successively.

At this point you might stimulate curiosity by asking some child at the back to stand up, and on ringing the bell or blowing the whistle, inquire if the said child heard it. But I rang the bell here. Query: Did the sound jump across? A little cross-questioning will not be amiss, but give no clue as yet. This episode will pave the way for the next experiment. Let the child take one end of a pine rod four or five feet long and one inch by quarter inch thick, and place his ear to it. Now scratch the other end with a pin. He will tell you all about it.

Then whisper some question—it will be unheard by the audience, but very distinctly audible at the end of the rod; he will answer correctly. Hold the rod horizontally, and pressing one end lightly against the panel of a door, vibrate the fork, and press its handle against the free end. The door panel sings out loudly; take away the fork the sound from the panel stops instantly. Remind them of the row of boys; the little bits of woods in this latter case swing to and fro, and pass the sound on. Now bring out a toy telephone, which consists of two short tubes of tin or pasteboard, each covered at one end with parchment, a long string being fixed to the middle of each diaphragm. The sounds spoken into the drum at one end when the string is stretched are transmitted along it to the diaphragm at the other end, and thence to the listening ear. So far all is clear to the children. Come back now to the old point. How does the sound from this whistle get to the back of the room, there being neither string nor board along which it can be passed on. Various answers will be given.

You might proceed thus, addressing yourself to the child at the end of the room. If I were to offer you a halfpenny and kept it in my pocket, it is clear that you would not get it. If I held it out to you, and you remained where you now are, you still would be unable to receive it. How do you propose to get it? (Suggested.) "I would come for it." "You would throw it." No, I won't do either. I will pass it to the boy next me, and he will pass to the boy behind him, and so on till it reaches you. Now you have it. I ring this bell by setting it swinging to and fro, and as you say you hear it, it is evident there is some busybody or bodies at work between me and you, passing on those swings till they reached your ear. Now I want you to think. When they have decided correctly, you must resume. It is quite true that the air can be set swinging, though it is too large to have a vibratory rate of its own. It is not often that a considerable portion is set going. Yet in storms no doubt you have felt the house rock, and seen broken windows. Sometimes large trees are uprooted by gusts timed to the vibratory rate of the tree. A large iron bridge was being built at Colebrooke Dale in America, when by came a fiddler and told the workmen that he could fiddle their bridge down. The workmen laughed at him, and told him he might fiddle away as hard as he liked they didn't care. (Fine slide effect.) One note after another was struck upon the strings until one was found with which the bridge was in sympathy. Then the bridge began to shake violently, and the alarmed workmen bade the fiddler stop. No doubt you have been in a church or other building when a massive bell or organ has been pealing. If so you will have felt the trembling of the air and the seats, and if you could have touched the windows you would have been even more surprised. Small portions of air, such as little boxes or tubes of air, are readily set in motion.

A very simple experiment shows this. Four cardboard tubes, 1 in. diam., and 16, 12, 10, and 8 in. long respectively, have the one end covered with a cardboard disc. Resting the closed ends on the table, they are allowed to fall one after another, and the four notes (doh, me, soh, doh), due to the air in the tubes vibrating, will be readily distinguished.

But though air is capable of conveying pulsations, it is not by any means so good as some other substances, some of which we have already tried. Water for example is much better. Place a tumbler of water on an empty cigar box (one short end having been removed). A small fork stuck in a block of wood is excited, and the block lowered in the water. The note will be heard proceeding out of the box; the vibrations have been passed on from the fork to the block, thence to the water, and from the water to the interior of the box. Refer to the earth as a good transmitter. Instance the blind man finding a watch by putting his ear to the ground.

Take a child's wooden whistle, cut off just behind the first finger hole, and fasten it into a glass tube three times its length. Close the end with a cork. Introduce into the tube a small quantity of very fine precipitated silica. Place the tube horizontally on the vertical attachment, and by playing soundly the scale upon it, a note will easily be found which acts as a command to the fine plates of silica, which thereupon stand erect in groups, separated from each other, and make a very striking show upon the screen.

If two tuning forks have the same pitch, and one of them be caused to sound, the other, though several feet away, will sound also. In this case the air acts upon the second fork, just as the one who pushed the swing in our first experiment. He timed his own movement to that of the swing. Here the air took its time from the movement of the swinging fork. A going clock may be made to set another precisely similar clock going by the same means.

Press down gently a bass C on a piano, so as not to make it sound. Now strike the C above it, holding down the key for a moment, and then letting go. The sound has not stopped though; it is being continued, but by the key held down, which was silent before, and on raising the key it stops at once. Now holding down the bass C as before, strike the G above the struck C, the sound of the G will be heard from the bass C as before. So we might go up, finding eight or ten strings, each one of which will make the low C vibrate, giving out the higher note. And the process may be reversed; by striking the lowest and holding the highest each will be set vibrating.

Show difference of pitch by open and closed pipes of cardboard. Resonance can also be illustrated by holding an excited fork over different tubes, or one tube shortened by pouring in water as required. It is necessary now to show how vibrations are counted. Expensive apparatus is not necessary. The principles involved can be shown practically, and such apparatus as the siren (though it is easily made) also Savart's Wheel can be shown as slides, and explained.

I remember once being in a like fix myself, and tried all manner of ways out of the difficulty, when a few days after I espied a lad playing with the very thing, and he was delighted to lend it for the benefit of his schoolfellows. He called it a Water-saw. It was actually a Savart's Wheel, unmounted. A toothed disc of metal (tin or iron), provided with two holes equi-distant from its centre, through which was passed an endless cord. By placing the hands in the loops of the cord, and pulling in opposite directions, the notched disc is caused to rotate, and if it be brought in contact with the edge of card firmly secured, the taps soon blend into a musical sound.

Then we come back to the tin whistle or flageolet, of which a section should be shown on the screen. It should be shown that it is an open pipe, since it practically terminates at the slit. Show the form of mouth-piece, by which the air is directed in a thin stream against the thin edge of the opposite side of the embouchure, which sets up a responsive fluttering in the air enclosed in the pipe, the pitch of the fluttering varying with the length of the pipe. Have by you glass or cardboard tubes of the relative lengths, 1 $\frac{9}{8}$, $\frac{5}{4}$, $\frac{4}{3}$, $\frac{3}{2}$, $\frac{5}{3}$, $\frac{15}{8}$, 2, bringing these fractions to a com. denom. we have 24, 27, 30, 32, 36, 40, 45, 48. If we agree to regard them as so many quarter inches, it will give us one foot for the longest tube and half a foot for the shortest—not an inconvenient length. By blowing over the tops of these, compare with the flageolet. Show how, when all the holes are closed, we have the long pipe giving the fundamental note, and by opening the lowest hole we shorten the tube by so much corresponding to the next tube, etc.

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Stereopticon Cyclorama.

WITH reference to the above, which appeared in our issue for March, Mr. John Winter, Sen., of Syracuse, N.Y., U.S.A., writing to the Editor of our contemporary from whom we quoted, disputes Mr. Chase's right in claiming to be the inventor, and says:—

> Kindly permit me to demonstrate a fact in your valuable MAGAZINE that I may at least enjoy the glory of being the first inventor of the cycloramic camera and the stereopticon cyclorama. While visiting the panorama in Munich, Germany, in 1885, I conceived the idea, and had the invention completed in 1890. My friend, Mr. Emanuel Sands, of Jersey City, interested himself with friends to bring it to Coney Island in operation, but was not successful. The proprietors of summer resorts in Rochester, N.Y., and across the Onondaga Lake contemplated to put up buildings and secure the invention; also the directors of the Syracuse City electric car-line intended to put up a building on the terminus of their line, to operate it. In 1891 I advertised in the Chicago papers to form a stock company to operate it during the World's Fair. In 1892 I forwarded photographs of the drawings and description on application, which were never returned. Mr. Charles A. Chase, of Chicago, dated his invention back to the time of Daguerre. (I cannot comprehend how Daguerre could perform that trick with the aid of an oil lamp.) According to the article in the January number, Mr. Chase says he tried the cylindrograph, and afterwards Mr. Percy S. Marcellus' cycloramic camera, and Mr. Marcellus kindly loaned the negative of the Court of Honor, from which he made the stereopticon slides and with such success that he constructed the cyclorama stereopticon exactly like the one shown by my photograph and description, with the only difference that his apparatus is suspended from the ceiling and mine rests on the floor.
>
> I can prove by the aforesaid parties, by my attorney and numbers of others, my assertion to enjoy at least the glory of being the original inventor of the cyclorama camera and of the stereopticon cyclorama.
>
> Wishing the cyclorama success for the enjoyment of the fraternity and the public at large.

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Bags versus Cylinders.

BY THE SHOWMAN.

AMONG the users of mixed gas jets supplied from cylinders there must be many who, finding they have either to pay an exorbitant price for compressed coal gas, or to use a saturator, have at one time or another asked themselves if, after all, the cylinder system was really the best, and who, coming to no conclusion on the subject, have continued to go on as before. And in the minds of such the question has again arisen on hearing of the late fatal accident.

When the present cylinder system was introduced, it was claimed that the great safety of cylinders lay in the fact that it was impossible for the user to get an explosive mixture, a point which was readily conceded by anyone who gave the subject a moment's thought; but, unfortunately, recent events go to show that cylinders have brought in their train a new series of dangers which were unknown when bags were solely used. It is often argued that accidents are less numerous with cylinders than they were with bags, notwithstanding the increased use of the former; this is very probably true, but the argument is beside the mark, as it is the results of explosions rather than their rarity which have to be considered. For instance, if the late accident instead of affecting a solitary individual, had taken place in the midst of a bank-holiday crowd at the same spot, and, say, killed four and injured twenty others, who would venture to assert that such disaster had ever been wrought by the explosion of a bag? The accident on the 15th March, occurring as it did in a public place, almost in the very heart of our excitable Metropolis, has attracted so much attention as to make it certain that the matter will be fully thrashed out; in fact, in one weekly newspaper not usually addicted to lantern matters, the writer found no less than four paragraphs on the subject in one issue.

Another objection to cylinders is that such a lot of fittings seem to be required. I lately saw at work a triple lantern supplied from two large cylinders, the apparatus including no less than ten-wheel valves, two gauges, and two regulators, besides the cylinder valves and usual dissolving taps on the lantern. The arrangement was as follows:—Next to the cylinder valve a wheel-valve was connected, above that again another wheel-valve giving access to a branch on which the pressure gauge was screwed; on top of all a regulator, and two wheel-valves on each of the jets in the lantern. Now I do not say that all these fittings were necessary, personally I think not, but it stands to reason that the owner of this wonderful kit thought them, if not necessary, at least desirable, or he would not have had them there. Now, had bags been used nothing more would have been required than the taps on bags and jets, and the dissolvers on the lantern. One point in favour of bags I have not yet seen noticed is, that except when actually in use they are emptied, folded up and put away, and are, so to speak, out of action, whereas cylinders are often kept with the full pressure in them for days, weeks, and even months, unless the valve be leaking. It would seem from the experience of the last few years that accidents with cylinders are invariably fatal, whereas accidents with bags and retorts are often trifling, although I believe there are authentic records of a few fatal accidents. Making one's own gas may be inconvenient, but it is better to endure that than to have gas compressors refusing to fill one's cylinder after some fatal accident, a decision against which there is no appeal.

Accidents occurring in the use of retorts and bags are always due to gross carelessness, even indifference, on the part of the user, and are often brought about by that peculiar habit many amateurs have of always taking three or four friends with them whenever they have anything to do with lantern exhibitions; and these well-meaning but wrong-doing folk being allowed to lend a hand in, and interfere with the arrangements, work, each according to his own ideas, and generally assist towards catastrophe.

As an instance, a gentleman holding an appointment as county analyst once went to a hall to lecture, using bags, and took with him an assistant and one or two pupils. The bags were filled and placed between the boards, when the assistant noticed that one of them was not as full as it might be, promptly removed it, and connected it to a gas bracket, and filled it; having done so, he discovered that it was the oxygen bag, and fully realised the extent of the mischief. The lecturer, being appealed to, told him to take the bag and empty it in the open air. He took it into a passage and there tested it with a light. Result:—Damage to assistant, none beyond the shock; damage to glass, nearly £30.

Bags we are told occupy more room than cylinders; that is so, but as they stand immediately behind the lantern, they occupy room which is of no value as seating space. The trouble of getting weights is another difficulty often brought forward, but it is more theoretical than practical, as for home use the weights wanted can be bought second-hand at about 4s. per cwt., and when away from home weights are often to be found at halls, or, if not, can generally be borrowed from some tradesman in the same street.

There seems to be an idea abroad that if the weights are removed or displaced from the bags while the light is burning, either one bag or the other, or both, will immediately explode. Such a thing could not possibly happen, as both gases are absolutely incombustible if unmixed. The probability is that one of two things would happen. Either a mixture would take place at once in the jet chamber, which would explode and snap the light out, or a little hydrogen would burn at the jet, and the rest would pass into the oxygen bag, where, after some minutes, an explosive mixture would be formed, which would be fired from the light at the jet. The latter would probably happen if we were to work an oxygen bag quite flat and almost empty while the coal gas bag was about half full, as Mr. Lewis Wright tells us was once his case.

Retort explosions may be divided into three kinds, viz., explosions of the chemicals, owing to the introduction of carbonaceous matter; steam explosions from leaving a retort to cool while coupled to the purifier, and the setting on fire of the retort and mixture through defective workmanship in the retort. The first may be guarded against by buying chemicals from a druggist of repute, and letting it be understood what they are wanted for; the second, the only result of which would be the blowing off of the tube, and the scattering of dirty water, may be prevented by uncoupling in time; and the third is caused by a leak in a seamed retort, through which the oxygen blows and sets the retort itself on fire. Such a flaw may be detected by screwing on the arm of the retort, and placing the body part under water and blowing hard down the delivery tube, when, if a leak exists, bubbles will rise from it. Retorts are often fitted with safety valves, which are sometimes a nuisance, and quite unnecessary if the delivery tube has a bore of at least half an inch.

I am sure that few who have ever enjoyed the feeling of independence and self-reliance possessed by those who are their own gas producers, will ever adopt cylinders from choice, though they will always of necessity be used by those who, from one reason or another, are unable to give the few minutes necessary to oxygen making.

In conclusion, let me add what may perhaps be a small grain of comfort to cylinder users. I think it is a German proverb which says, "Remember whatever be thy fate that it might and ought to have been worse"; at any rate it is almost certainly better to be killed by the explosion of an oxygen cylinder, than to perish by the bursting of a pipe containing high pressure steam, as in the former case one is killed instantly, while in the latter the victim is scalded internally as well as externally, and suffers intense agony before death supervenes.

Slides for Science Teachers.

ELECTRICITY.

By E. D. Bartlett.

There are a large number of experiments in Electricity in which the apparatus is of such a nature that it can be made on a small scale and adapted to the lantern easily.

By the aid of a small glass tank the principle of a single fluid cell battery can be readily projected upon the screen. A simple piece of apparatus, part of which is illustrated on page 8 of this Journal for January, 1895, will serve the purpose. The drawing Fig. I. shows the arrangement; the base (J) and uprights (K K) are the same together with a suitable glass tank. As the water used in the tank is to be acidulated, care must be taken that the parts are not acted upon, and also that it readily lends itself to be taken to pieces for the purpose of cleansing. The tanks shown in the sketch Fig. I. is very simple in construction and is made by bending a piece of vulcanised rubber between two plates of glass into the shape shown, and then binding them together at the ends with twine. To prevent the edges of the glass from cutting the twine it is as well to somewhat round them upon a piece of flagstone. Across the two uprights is a piece of wood (E), held in position by the two projecting pins (H H); a piece of copper and zinc (C) and (Z) is passed through, which can be either small round rods or sheets with their ends slightly projecting above, but for some distance below. The ends projecting above are connected by wires to the binding screws (S S). The tank is nearly filled with some dilute sulphuric acid H_2SO_4 and the two metal rods placed in position as shown in the drawing. Place the whole in front of the condenser and focus upon the screen. Connect the zinc and copper rods together by two leading wires inserted one in each binding screw, unite

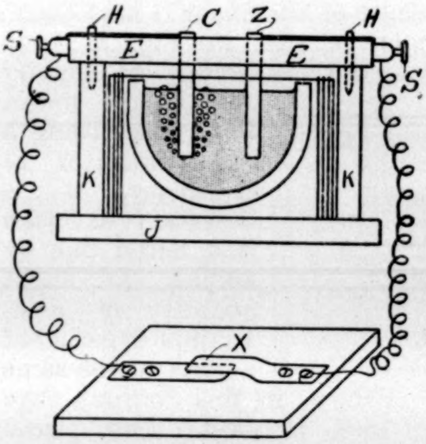

Fig. I.

their ends, and bubbles of gas will soon be seen to come off from the copper plate. As a means of forming a ready method of connecting the two wires together, the following simple key will be found useful in this and other experiments, or any of the numerous forms that are in use and can be bought for a few pence at every electrical dealers. The method of constructing the key is as follows:—Two pieces of brass are secured, each by two screws, to a suitable base of mahogany, the pieces of brass overlapping one another, but one bent so that when in its normal state not to be touching one another, as shown in the lower portion of Fig. I.; the wires for connecting are secured to the two outer screws, which must be of brass also. When it is required to make contact it is only necessary to press the finger upon the part marked (x), and the circuit will be completed and will remain so as long as the pressure of the finger is kept there.

The arrangement shown in Fig. II. will clearly illustrate the electrolysis of slightly acidulated water. Pure water being a bad conductor of electricity, it is necessary to make it a better one by adding a slight quantity of acid. In this experiment a tank of the same description as that shown in this Journal, page 189, November, 1894, is used. Two pieces preferably of platinum wire are bent round at one end to form an eye, and the other ends are inserted through the india-rubber separating the sides of the tank. Place the tank in the lantern as in the former case, and connect the loops or eyes (M N) to the wires from a battery. A small bichromate battery about a pint capacity will be found the handiest for experiments of this description, as by raising or lowering the zinc element the strength of current is more under control, besides giving off no destructive fumes to destroy any brass work that may be brought in close proximity to it. The small key described above and used in the preceding experiment will be found useful in this experiment also by inserting it in the circuit.

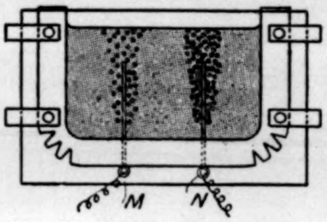

Fig. II.

As soon as contact is made gas will be seen to be given off from the platinum points surrounded by the acidulated water. By placing two inverted test tubes filled with the acidulated water over the platinum rods gas may be collected. The gases will be seen to come off more rapidly from the one than the other, and will soon make itself apparent by the difference of the volume of gas in the two tubes and consequent lowering of water. The gas evolved from the negative pole will be twice as great as that which collects at the positive pole.

Another experiment, showing the effect of the current, can be shown by stitching together several thicknesses of blotting paper and placing it in the tank, dividing the tank into two portions; pour in on both sides of the porous diaphragm so formed a solution of sulphate of soda coloured with litmus. Colour the solution on one side of the porous diaphragm in which the negative electrod is red, by adding to it one or two drops of dilute acid. When the circuit is completed it will be seen that the blue becomes red, and the red blue, and by reversing the poles an opposite effect will be obtained.

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Water and its Effect on Our Work.

By Duncan Moore.

The purity and brilliance of our transparencies and negatives are considerably influenced by the quality of the water used in their preparation. Chemically, pure water exists mainly in theory, rather than for any available supply. Distilled water being the nearest approach to it we are likely to get, and that very often is far from what it professes to be. The mystic capitals HO, represent the chemical constitution of water, but the component parts of the water we have to avail ourselves of would be more nearly represented by all the letters in the alphabet. Pure water consists of a mixture by weight of eight parts of pure oxygen gas with one part of pure hydrogen; if it contain anything else it must exist as an impurity. The sea is the primary source of all water, by evaporation, it is carried over the land by clouds, and is discharged from them as rain, to afterwards present itself as river, spring, and well-water. Rain-water if collected at a long distance from towns, or manufactories, or other sources of contamination, and at a great altitude is the purest form of natural water, but even under these conditions it is not absolutely pure, as a certain amount of foreign matter floating in the atmosphere is carried down with it. That, however, collected near towns is on the contrary extremely impure, the air being greatly contaminated with ammoniacal and other detrimental vapours that impregnate it, to say nothing of the thousand-and-one impurities in the dust lodging on the roofs, etc., from which the water is gathered. It is always best in collecting rain-water from any source to allow the first of the shower to pass away into the drains before reserving any for photographic use. If this is done, and the water well filtered before use, it will be found tolerably pure, and good enough for most photographic operations. The most important photographic use, necessitating pure water, is making solutions of silver nitrate, in which case any contamination of organic, or saline matter would cause decomposition. If it so happens that there is no choice of water, and a known impure sample is to be used, the best plan is to first boil it in order to precipitate any lime, afterwards add a few grains of silver nitrate and expose to the brightest sunlight available for a day or two, the organic matter will by this means be precipitated as a black mud, and, although the water thus treated will not be absolutely pure, still it will be sufficiently so for most purposes, after filtering, in which silver nitrate has to be dissolved. Spring water, and river water, are next in order of purity, but (there is a great deal in this "but") it altogether depends on the soil through which the spring flows. Springs are caused by rain fall on higher grounds through which they filter, and in their course dissolve any soluble matter in their passage. In chalky soil, spring water is saturated with lime, but is tolerably free from organic impurities. If we take such water, clear and sparkling as it may appear, for development in which oxalates are used, we immediately get into difficulties by a precipitation of oxalate of lime in our films, which causes a granular muddy appearance, unfitting the transparency for lantern work; in fact, any development in which lime-salts are decomposed, or precipitated, indicates that such water should be deprived of its lime by boiling for a considerable time. Lime, however, is not, the only substance likely to be found in spring water, chlorides of various kinds, metallic impurities, more especially iron, magnesium, and soda, as we see by our medicinal and chalybeate springs. The earth surrounding and over which the spring flows, when iron is contained in solution, proclaims its presence by the rusty colour of the precipitated oxides.

Sulphates and chlorides are, of course, not noticeable in this manner, but detectable by taste when they occur in important quantity. Hydrates are frequently present; in fact, almost always, their quantity or character depending mostly on the soil through which the water flows. Water is one of the most powerful solvents known, and at various temperatures few things are not more or less soluble in it; even glass is, by its long continued action at a high temperature, corroded away. It is, therefore, easily understood how it becomes almost impossible for such a fluid to be anything like pure in a natural state. Water proceeding from glaciers and snow on lofty mountains is its purest form.

River water is a mixture of drainage and spring water, and of necessity much more impure, being additionally contaminated with organic matter in all forms. Putrefactive and excretive matter is being continually added, but by a fortunate dispensation of Nature they soon become oxidised and deposited as mud, forming a nutritious soil for plants and vegetation of various kinds, the plants in their turn further purifying the water in which they grow by the absorption of various earthy salts that are contained in solution. So the process continually goes on — addition, decomposition, absorption, and purification, until the main bulk of the stream becomes bright and useable. The pollution of the water by manufactories is sometimes carried to such an extent that a river becomes little better than a sewer. Water from such a source is evidently useless for photographic purposes, as no amount of filtering or subsidence will remove the obnoxious matter, distillation being the only possible means of making it suitable.

Rivers flowing through sandy and gravelly soils are generally purer than those where the bed is of a clayey or chalky character. River water is usually termed soft; that is, the sulphates contained in it are insufficient to curdle a solution of soap. Hard water, which contains a superabundance of these salts, has an opposite effect. Well water varies in its composition more perhaps than that from any other source; the depth of the well and kind of soil in which it is sunk, and the various sources of contamination that are in the vicinity which percolate into it. As a general rule, well water obtained from diluvial gravel above the clay is more impure than from the green sand at a lower level, and water from wells sunk in the London clay are most impure of any, and contain on an average three times as much solid matter as deep Thames water. A good, pure, natural water is without odour, although the finer senses of some animals can detect it at a distance. Muddy water may be cleared by adding two or three grains of alum to a quart of it, then allowing it to subside. This effect is produced by the alum combining with the lime in solution, and forming an insoluble precipitate, which carries down other matter with it. For photographic use all natural waters should be well boiled and allowed to subside or be filtered.

Water purified by distillation is the best for all chemical purposes. It often happens that water sold as distilled water is far from pure, being contaminated by the vessels in which it has been stored — from the luting of the apparatus in distilling it, or from some other reason that could have been prevented by care. Good distilled water should be bright and odourless, and not show the least opalescence on the addition of silver nitrate. Should it be at all turbid or have the least smell, it may be safely concluded that it is impure, even if the silver nitrate test is satisfactory. Organic matter of some kind is in all probability contained in it. Lead is more easily corroded and dissolved by pure water than if it contains nitrate, carbonates, and sulphates. Distilled water, therefore, should never be stored in lead receptacles; glass or well glazed earthenware is best. Distilled water procured from the condensing engines of steamers or manufacturers' stationary engines is rarely free from oily matter; sometimes it is fairly good, but at others far from it. At any rate, it will not be wise to trust to the purity of water obtained from such sources.

The water supply of most large towns is tolerably pure, but it should not be used for photographic purposes, such as development, without filtering it through two or three thicknesses of fine flannel, or swansdown calico. A bag of this material may be fixed over the supply tap and form a permanent filter, taking it off and washing occasionally is all the attention required. It is surprising, even when the water seems bright and good, what a quantity of foreign matter will soon accumulate in this bag. It should also be boiled and allowed to stand before use. Many of the defects on negatives, and sometimes fogging, may be traced to the use of impure water when its appearance may have been all it should be.

As a matter of course any defect in a lantern slide is enlarged; those that would pass muster in an ordinary printing negative would ruin a transparency; therefore, any little extra trouble in ascertaining the water is not at fault is amply repaid by the clear, neat, and finished appearance of the slide.

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Notes on Lantern Slide Making.

By T. Perkins.

A short time ago, while I was engaged in the preparation of a lantern lecture, a large number of slides by various workers passed through my hands. They were of all qualities, some eminently beautiful, some good, many indifferent, and a few bad. The average character, however, of the slides confirmed my conviction that the making of a really good lantern transparency is by no means the easy matter it looks on paper. I intend in the present article to point out some of the defects most frequently met with, and to suggest how they may be avoided. But first we must enquire what constitutes a perfect slide. To this the answer must be:—Complete gradation from the deepest shadow which must not be absolutely opaque, to the highest lights which should be clear glass; moreover, the highest lights must occupy a very small area of the slide. Ruskin gives some admirable advice on this matter to painters, which may be equally taken to heart by photographers when he says "Make your whites precious and your blacks telling." As an instance of the observance of this rule, as far as the lights are concerned, he points out a well-known picture by Correggio, "The Cupid, Venus and Mercury," in the National Gallery, where the only pure piece of white is a spot of paint on one of Cupid's wings about the size of a pin's head, but of great luminosity owing to the subtle way in which this spot is led up to through gradations of half-tones of ever-increasing brightness. Compare this picture with the blank white skies in many lantern slides, and the inferiority of the latter is evident. If, however, the photographer can secure perfect gradation in his negative, and retain it in reversed order in his transparency, he will get a luminous whole, so that when the picture is thrown upon the screen it will have a natural effect, and not appear, as too many lantern pictures that we see do appear, as if they were intended to represent Nature as seen by the light of an electric lamp. To secure this effect, a good negative is indispensable. It must be full of soft detail, but at the same time neither flat nor over thin, or the slide itself will be flat. No fixed rules can be laid down for the colour of a perfect slide, much depends on the subject, something also on taste. One thing, however, may be said, namely, that many commercial slides made on wet collodion have a purplish tone which, to me at least, is not pleasing, either in a print or in a transparency. Pure black and greys are much more pleasing, and these are admirably suited to many subjects, such as winter scenes, effects of mist, of cloud and sea, and some architectural subjects. For figures, most architectural subjects, and for ordinary landscapes, a warm brown is as suitable as any colour that can be obtained. Defective slides may be classed as follows: heavy, hard, flat, thin, and veiled.

Heavy slides are generally caused by over development, and such slides are best at once converted into cover glasses by soaking them after fixation in a weak bath of hydrochloric acid (one for instance that has been used for the clearing of platinotype prints), after a short time in which the film will peal off bodily. Reduction, though it can be resorted to, seldom gives satisfactory results.

Hard slides are generally due to a similar fault in the negative, but if the only available negative is hard, some improvement may be made by giving a somewhat longer exposure in a brighter light, by bringing the printing frame, for instance, closer to the lamp if the slide is being made by contact, and by developing with a solution weak in the reducing agent, or by using a developer like rodinal which has a tendency to give thinner images. Hard slides are, however, not unpopular, in fact the general public seems to admire them; plenty of sparkling light, combined with deep shadows, producing an effect similar to limelit scenery on the stage, will often call forth rounds of applause, while a softer, more natural slide will be allowed to pass away from the sheet without eliciting any marks of approbation.

Flat slides are sometimes the result of thin and over-exposed negatives, sometimes of over-exposure of the slide itself. If the fault is due to the latter cause, the remedy is obvious, namely, to make a cover glass of the slide and to try a shorter exposure. If the fault is in the negative the lantern plate should be exposed in a weak light and developed only so long as the highest lights remain perfectly clear; it should then be fixed, and if the slide is thin it may be intensified in the manner to be presently described.

Thin slides are generally the result of stopping development too soon, either intentionally or accidentally. The cure for it is intensification. I have tried various methods of intensifying, and have found one perfectly satisfactory. Slides intensified with mercury bichloride followed by ammonia or washing soda, in the same way as negatives are generally intensified, may look well at first, but after a time they seem to fade; I have some which were thus treated about ten years ago, and although I know they were thoroughly washed, they have become but ghosts of their former selves. Mercury followed by rodinal has given nice colours, but there seems a tendency to fog. More recently I have followed a method recommended by Mr. John Hodges, and the results leave nothing to be desired, if the slides will stand the test of time. The slide is first bleached thoroughly with mercury, and then well washed; this process is best conducted in a weak light, a good swill under a tap and a soaking for about two hours in several changes of water followed by another swill will be ample. After this a weak hydroquinone developer, made by diluting the normal developer with two or three times its own bulk of water, should be poured on and off *in the dark room* until the white image is blackened right through, the slide should then be washed under the tap without exposing it to light, and then put into a clean fixing bath of the ordinary strength for a few minutes; it must then be washed to thoroughly eliminate the hypo just as if it had been developed and fixed in the ordinary manner. The result will probably be, if not an excellent slide, yet a great improvement on its former condition. I find that if the re-development is conducted in white light there is a tendency to veiling, which I have found the ordinary clearing baths powerless to remove.

Veiled slides are of frequent occurrence This defect is a most annoying one; it takes all the brilliancy out of the picture on the screen. It may be caused in several ways. First by white light falling on the plate in the dark room; next by the use of too much alkali put into the developer in the hope of bringing up a slide which has had too short an exposure. It is often said that an under-exposed negative plate is useless, but though this assertion is perhaps too strong, unless the plate has been very much under-exposed, it is perfectly true that an under-exposed lantern plate is of no use save as a cover glass. But veiling may be also due to dirty dishes. My own experiencein the way of failures from this cause may be of use to others. I used to develop lantern plates in a vulcanite or in a celulloid dish, the former was sometimes used for developing negatives with pyro and ammonia, the latter was used for lantern slides only. All went well for a time, the dishes were always carefully washed in water after use, but suddenly fogging set in, I changed the brand of plates, I mixed fresh developing solutions made from fresh bottles of hydroquinone, meta-bisulphite, and caustic potash, but all to no purmatter with it. For photographic use all natural waters should be well boiled and allowed to subside or be filtered.

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To get a perfect lantern slide the exposure must be correct; most photographers, despite Messrs. Hurter & Driffield's investigations, still cling to the belief that they can correct over-exposure, and also a certain amount of under-exposure in negatives by modifications in the development. But this is not the case with lantern plates. I do not mean to say that the slow series of plates by many makers may not with a view to producing various colours have various exposures deliberately given to them, to be followed by different forms of developer suitable to each exposure, but what I mean is that if a plate is found to be under-exposed or anything more than slightly over-exposed, on pouring the normal developer on it, it will be impossible to produce by any change in the developer that can then be made the same effect as would have resulted from a correct exposure. As correct exposure is so important, we must not expect to get a very high percentage of successes if we wish to make only one slide from each of a number of negatives, as even if we are lucky enough to hit on the correct exposure for the first slide, the next negative we take up may be so different in density and colour, that it may require an entirely different exposure, and we may have to make one or two attempts before we get the right time to give it. If a slide is not entirely satisfactory, or at any rate as good a one as we think we can get from the negative, it is better to put it aside for subsequent conversion into a cover glass. It is some consolation to know that our spoilt lantern plates can thus be put to a good use. After all it means that the glasses we use to cover our slides have cost us a shilling instead of sixpence or eightpence a dozen, which we should have had to give for cover glasses of the same quality, so that the loss of a dozen wasted lantern plates is after all not more than sixpence and the trifling cost of the developer used.

With one further piece of advice I will conclude. It is this: I should advise all workers to get thoroughly acquainted with the idiosyncrasies of the plates they are using. There are no plates on the market now that I do not believe to be good, but the same treatment does not do for all, nor do all behave in the same way. One brand of plates, namely, the Paget Prize Slow Series, of which I am exceedingly fond, since on them I can obtain the rich brown which I admire, have this peculiarity, that the image appears gradually at first, then suddenly begins to gain richness and density with great rapidity, so that it does not do to leave the plates unwatched even for a quarter of a minute at the critical stage of development. But there are other brands of plates which I find develop much more gradually, so that it is quite safe after putting them into a developer to leave them in the dish on the rocker and to go out of the dark room to expose another plate.

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Patent Intelligence.

No. Recent Patent Applications.

3475. 18th February, 1895. H. J. Helsdon. Improvements in or in connection with magic lantern slide carriers or slide carrier blocks.

5102. 11th March, 1895. A. Barrett. Improvements in electric arc lamps for optical lanterns, projectors and the like.

5483. 15th March, 1895. L. Wright and J. Anderson. An improved screen for optical projection purposes.

5626. 18th March, 1895. T. Allchin. Pressure cylinder protection case.

5884. 21st March, 1895. P. P. Burt. Improvements in lamps for optical lanterns and the like.

6233. 26th March, 1895. A. E. Bingemann. A case to control the gas from a burst cylinder.

6502. 29th March, 1895. H. C. Bryde. Improvements in lantern slide carriers.

6526. 30th March, 1895. Wm. Penman. An oxygen supply attachment to the incandescent gas lamps in the optical lantern.

6545. 30th March, 1895. G. Davenport. An improved electric arc lamp for optical lantern and other purposes.

6557. 30th March, 1895. S. V. Evans. Improved apparatus applicable to the working of electric or limelight, for theatrical purposes.

6562. 30th March, 1895. G. Barrow and the Interchangeable Automatic Machine Syndicate, Limited. An improved mechanical kinescope for exhibiting photographic pictures in motion in combination with photographic mechanism.

7046. 5th April. W. Hornby. A new or improved case for the reception, conveyance, and use of oxygen cylinders and the like.

RECENTLY PRINTED SPECIFICATIONS.

No.
7136 of 1894. Lake (Hudson). Magic lanterns.
811 of 1895. Arendt. Mantles for incandescent gas burners.
7673 of 1894. Dickinson. Optical lantern apparatus.
8304 of 1894. Haslam. Gas compressors.
14446 of 1894. Jones. Enlarging and reducing from photographic negatives.
9742 of 1894. Pope. Vessels for gas under pressure.

Editorial Table.

BEARD'S CATALOGUE.—Mr. R. R. Beard, 10, Trafalgar Road, S.E., has sent us a copy of his new catalogue. Besides being the maker of the well-known gas regulator which bears his name, Mr. Beard is now making and dealing in fine adjustment valves, cylinder connections of all kinds, lanterns, carriers, and other apparatus which the lanternist from time to time requires.

TAYLOR, TAYLOR & HOBSON'S CATALOGUE. — In a new catalogue received from this firm, they state that the new Cooke lens for hand cameras and lanterns will shortly be issued by them.

"PRIMUS" SPECIALITIES.— A neat catalogue of the above has been issued by Messrs. Butcher & Son, of Blackheath. Particulars are therein to be found of "Primus" hand and other cameras, stands, lenses, magic lanterns, and general fittings and sundries that are in continual use by photographic and lantern amateurs.

Messrs. NEWTON & Co., of 3, Fleet Street, London, have issued the following circular to their customers. "We beg to inform you that we have made arrangements with Brin's Oxygen Co., Ltd., to test and re-anneal free of charge all cylinders which have been supplied by us, and which may be sent to them at their Works, 69, Horseferry Road, Westminster, within two months from this date. We have made these arrangements in order to allay the very natural apprehension which may be felt by some of our customers by reason of the recent failure of a cylinder supplied by us, though the Government expert states that the cylinder in question was in no way defective, and that the accident was due to other causes. All cylinders after passing the new tests will be stamped by Messrs. Brin. These tests are the outcome of the most careful consideration, and we believe that cylinders bearing their test mark may be fully relied upon as complying with the recommendations of the Board of Trade and the requirements of the railway companies. Kindly send your cylinder, *carriage paid*, to Messrs. Brin at the above address as soon as possible, with your name and address legibly written on the address label, together with the words 'from N. & Co.,' so that the cylinder may be recognised by Messrs. Brin as coming under this arrangement. Any cylinder supplied by us since the 1st January, 1894, which may fail to comply with the new tests in every respect will be replaced by a new one which has satisfactorily passed the tests. Should any cylinder supplied before 1st January, 1894, fail to pass the new tests, notice will be sent to you by us, and we shall be prepared to quote very liberal terms for the supply of a new cylinder. All new cylinders supplied by us after this date will be obtained by us from Brin's Oxygen Co., Ltd. As mentioned in a previous circular, we take no responsibility for either new or refilled cylinders. Refilling.—We have arranged that Messrs. Brin shall undertake the refilling of our customers' cylinders in future at their list rates. These arrangements having been made by us in the interests of our customers and at considerable cost to ourselves, customers omitting to avail themselves of the above arrangements must do so upon their own responsibility. We would caution our customers against allowing any oil or grease to come into contact with the cylinders. P.S.—All cylinders should be re-tested once a year, and re-annealed occasionally."

Correspondence.

Re CURTAIN POLE SATURATOR.

To the Editor.

SIR,—I noticed in last month's issue, page 72, in reply to the letter which you forwarded to me from Mr. Sanderson of Canada, in quoting from Mr. Goodwin Norton's speech at the Lantern Society (which was reported in full in your March, '94, number) of a burst saturator, the word "his" instead of "a" has crept into the letter (evidently a printer's error). Perhaps you will kindly point this out in next issue.

Yours, etc.,
SATURATOR.

[We regret to announce the death of the Rev. J. G. Sanderson (who is referred to in the above letter), which took place on March 25th, after an operation for appendicitis. Mr. Sanderson is described by a friend as a man of earnest piety, unfailing charity and sanctified wit, a careful student, a wise pastor and friend, and a great inspiring force in the temperance cause. As an expert lanternist, the late Mr. Sanderson was a supporter of ether saturators and has done much to popularise them in Canada.—ED.]

MR. PRINGLE'S CHALLENGE ACCEPTED.

To the Editor.

SIR,—I accept Mr Andrew Pringle's challenge printed in your last issue, since I believe I have a jet that will compare favourably with either of his.

I would prefer that the competition should be confined to the one point, viz., the greatest candle-power obtainable from each jet, leaving out all question of the amount of gas consumed, but I am prepared to accept any conditions that may be decided upon.

Yours truly,
W. SCARBOROUGH.

Alyn Bank, Crescent-road,
Crouch End, N.

Notes and Queries.

W. H. Shrubsole writes :—I seek your advice on the point whether a lecturer who aims at presenting lantern illustrations in the best possible way, should have his slides mounted in wood blocks or not? I must add the assumption that the lecturer does not provide lantern or operator. I have been using some good slides mounted in blocks, in town and country, and have had a varied experience. At some places there was a single instead of a bi-unial, and therefore my "effects" could not be shewn. At other places the lanterns would not take my 7 in. by 4½ in. blocks, and in other cases the stage would not admit the mechanical slides, ⅞ in. thick. Sometimes a bi-unial had no registration "stops," and on applying those I carry with me, then the space was so curtailed that the blocks would not enter. This was the case at the Royal Victoria Hall, Waterloo Bridge Road, where I lectured on Tuesday last, "On curious dwellers on our shores." Owing to the absence of "stops" the effects were not properly shown. There is much to be said in favour of wood blocks, but I can hardly make up my mind which plan to adopt in preparing other lecture illustrations. *Ans.*—The only thing to do under the circumstances is to effect a compromise. Put your effects in blocks seven inches long by four wide and these will of course only be used if a bi-unial lantern happens to be at the place of meeting, the other slides may be used in a "to and from" carrier. You will thus arrange on the supposition that only a single lantern is available. You speak of your mechanical slides being ⅞ in. thick, surely these can be reduced to ¾ in. It will be best to try each slide in the lantern (beforehand of course) with the carrier spoken of with which effects are required, then with the effect and block in the other lantern, plane or cut away or add as the case may be until both are on the same level. Having adjusted the distance, secure small stops to the under sides of both carrier and block, so that when pushed right home they touch the stage. It will be well to mark which side of the carrier each slide goes into. This arrangement, with a little common sense displayed by the operator in "trying" the effects before fully turned on, seems the only way out of the difficulty, but the absolute precision of the effect will rest with the operator, who must resort to a little dodging. Use the carrier in the bottom lantern (with biunial) and keep the top for the effects only.

W. W. Herbert asks:—1. Does the injector mixed limelight lately brought out give a light equal in every respect to the ordinary mixed jet? 2. Is it possible to set Beard's regulator to deliver at a pressure of from 12 to 15 lbs. per square inch? *Ans.*—1. We are not in a position to speak of the injector jet, not yet having tried it, but we will do so shortly and give an account of same. 2. The regulator would require to be specially made to give 12 to 15 lbs. per square inch. In its ordinary commercial form Beard's regulator is set about 3 lbs., when all is closed and no gas taken and reduces to about 2 lbs. when in use. The commercial form has a bellows which would burst with a pressure of 12 or 14 lbs., and to work at that pressure would require the rubber bellows to be made stronger in proportion. The spring would also require to be stronger.

R. L. and several others write asking if we can give any particulars of the wonderful "Cambrian" saturator advertised in this Journal, but we can only say that we know nothing as to its capabilities, nor even its shape, as the inventor has, up to the present, not even sent us a circular pertaining to same.

Geo. Cook writes:—Can you tell me how to become a member of the Lantern Society? *Ans.*—Write to the Hon. Sec., Mr. W. Bashall, 21, Holland Villas-road, London, W. The meetings are held at 20, Hanover-square, W., and the annual subscription is ten shillings. There is no entrance fee.

Timor writes:—There is inside my 20 feet cylinder (oxygen) a detached piece of metal which, when the cylinder is being carried, can be distinctly heard running from end to end. Would it be possible for this piece of metal in quickly passing through the steel cylinder to create a spark by friction? If a spark was thus created inside fully-charged cylinder, what would be the result? *Ans.*—It is highly improbable that the loose piece of metal would create a spark. Still, for the sake of peace of mind, you might have it taken out the first time you send your cylinder to be annealed. In that operation the valve has to be taken out and the small piece of metal (probably solder) may be emptied out. Were a light suddenly to take place inside of a charged cylinder, the flame being fed with the oxygen would burn very fiercely, and would quickly burn through the cylinder and anything else that happened to be lying in proximity. Under such conditions a cylinder containing an admixture of oxygen and hydrogen would explode.

Uncle Will.—My Lawson's single saturator being charged with methylated ether, burns well and brilliantly for twenty minutes or half-an-hour attached to an oxygen cylinder of Brin's. After that time the light becomes unsteady and variable for a few seconds, and then the picture that is being projected vanishes altogether. The stream of pure oxygen appears to cease, but there is still plenty of flame from the ether. The saturator is quite a new one, was purchased in London, and was well blown out before using it. *Ans.*—If the saturator had a good charge of ether when being commenced to be used, and when cold, burned as you say, all right; after a time, when things warm up a little, it is often necessary to turn the handle a little more to the right to permit of allowing a little more oxygen to reach the nipple, and if necessary to slightly cut off a little of the saturated supply (which is equivalent to hydrogen in a mixed jet). Have you tried this? Again, had the charge of ether been very small it might in that time have become incapable of thoroughly saturating the oxygen and you would have too much direct oxygen for the supply of gas, which should be thoroughly saturated, and which would now contain a percentage of non-saturated oxygen. If that be the case turn the tap handle more to the left, so as to limit the supply of pure or direct oxygen. By doing this, however, you will under these conditions have a pop when you put the light out, and it directs attention to the fact that you have an insufficient supply of ether. If, after trying as we suggest, the fault is not remedied, write again, stating fuller particulars, and stating at the same time the charge of ether used. If, however, we have pointed out the cause you might drop us a post card to say where the fault lay.

G. P. Duffus says:—I am making a bi-unial, and I would like to know where I can get brass fittings from. *Ans.*—We understand that Messrs. Noakes & Son, Nelson-street, Greenwich, make a special feature of supplying amateurs with these, either in the rough or finished. Write to them for particulars.

W. H. Sinman writes:—I have a lantern, but do no know the focus of the lens. Could you tell me how to ascertain this? The lens is composed of three glasses. *Ans.*—It is evident that you have not been a reader of this Journal for any length of time, else you would have observed that we have repeatedly answered this question. A ready means of ascertaining is as follows:—Fasten a small sheet of white paper on the wall, say immediately opposite a window in a room, then hold the lens in front of this, front lens towards the window, and move backwards or forwards until you see a sharp image on the paper of chimney pots or other objects in the distance. When the image is sharp, measure the distance from the sheet of paper to a point midway between the front and back combinations of the lens. Supposing this to measure eight inches, eight inches will be the equivalent focus of the lens.

Ajax asks:—Why is it that lanterns are used only in the winter months and never during the summer months? *Ans.*—Lanterns are used all the year round. It is a mistaken idea that they cannot be used during the summer, for they are, and to a great extent too. Nowadays we hear of the lantern season, but this is only because they are used to a greater extent during the dark evenings. By-and-bye people will get to know better, but it takes time.